Megacity Aerosol Experiment – Mexico City

OVERVIEW of MAX-Mex

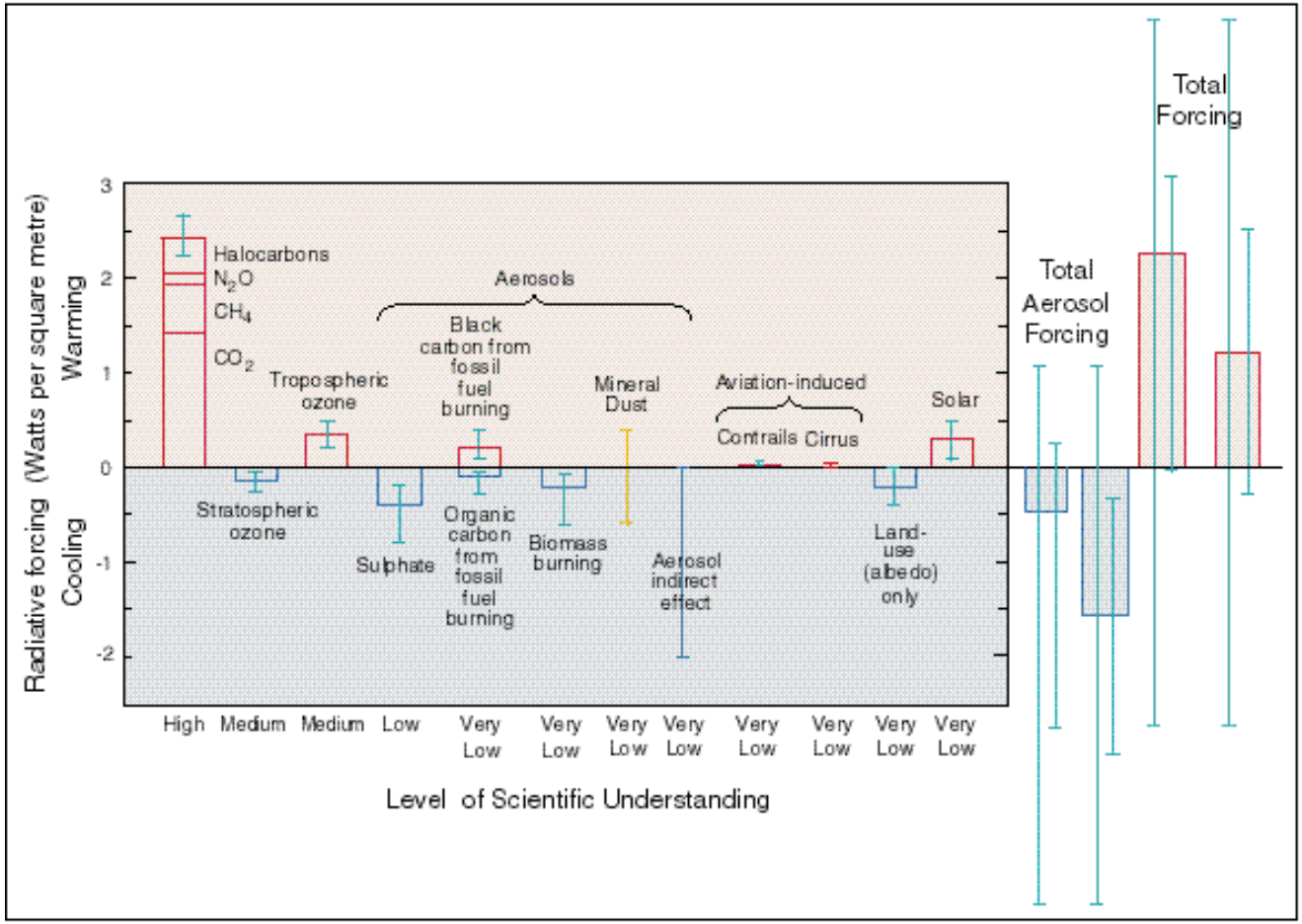
Jeff Gaffney

University of Arkansas at Little Rock, Little Rock, AR

ASP Science Team Meeting – February 25, 2009, Santa Fe, NM, USA

AEROSOL IMPACTS –DOE FOCUS
Atmospheric Science Program

http://www.asp.bnl.gov/



Direct Aerosol Forcing – Scattering and Absorption

MAX-Mex Focus

Aerosol Direct Effects – MEGACITY SOURCES

- Primary Organic Aerosols –Black Carbon
- Secondary Organic Aerosols

Enhanced Absorption from Organics
AGING – Do the Aerosol Absorption Change

Removal Processes – Rain Events

MEGACITIES

➢ *10 Million*

1950 – 1 (NYC)

1995 – 14

2015 – 21

Mini – MEGACITIES

5 Million – 10 Million

1995 – 7

2015 – 37

ASIA – AFRICA

2/3 rural to ½ urban by 2025

MILAGRO - March 2006

Megacity Initiative - Local and Global Research Observations

MCMA-2006 – *Mexico City Metropolitan Area – 2006*

Lead Scientist – Luisa Molina (Molina Center for Energy and Environment, MIT)

Adrian Fernandez – Instituto Nacional de Ecologia

MAX-Mex – ***Megacity Aerosol Experiment – Mexico City***

DOE: Lead Scientist, Jeff Gaffney (ANL, UALR)

Program Managers: Rickey Petty, Ashley Williamson

MIRAGE-Mex – *Megacity Impacts on Regional and Global Environments – Mexico City*

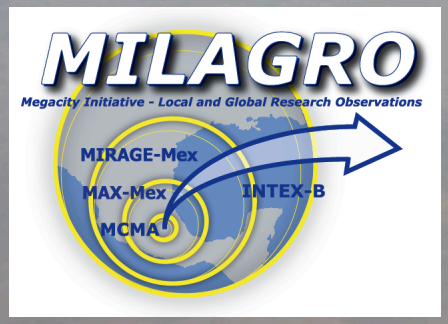
NSF: Lead Scientist, Sasha Madronich (NCAR)

Program Manager, Anne-Marie Schmoltner

INTEX-B – *Intercontinental Chemical Transport Experiment (NASA, NSF)*

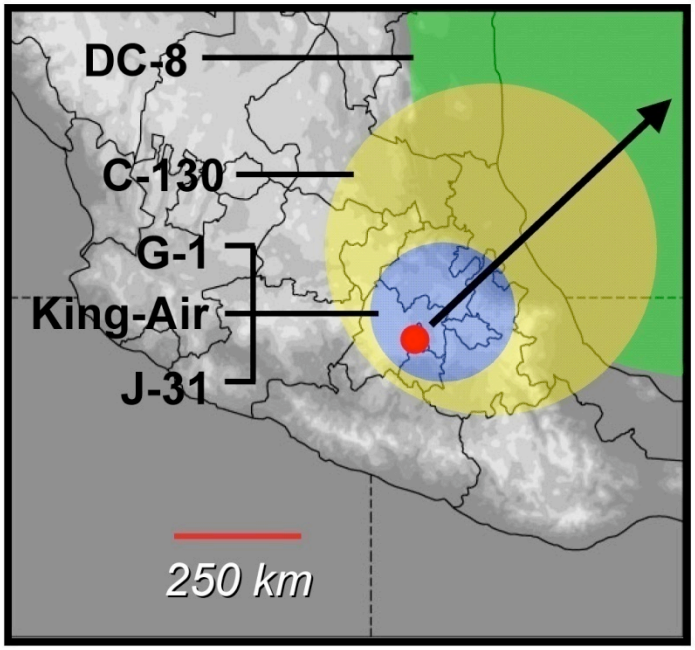
NASA: Lead Scientist, Hanwant Singh

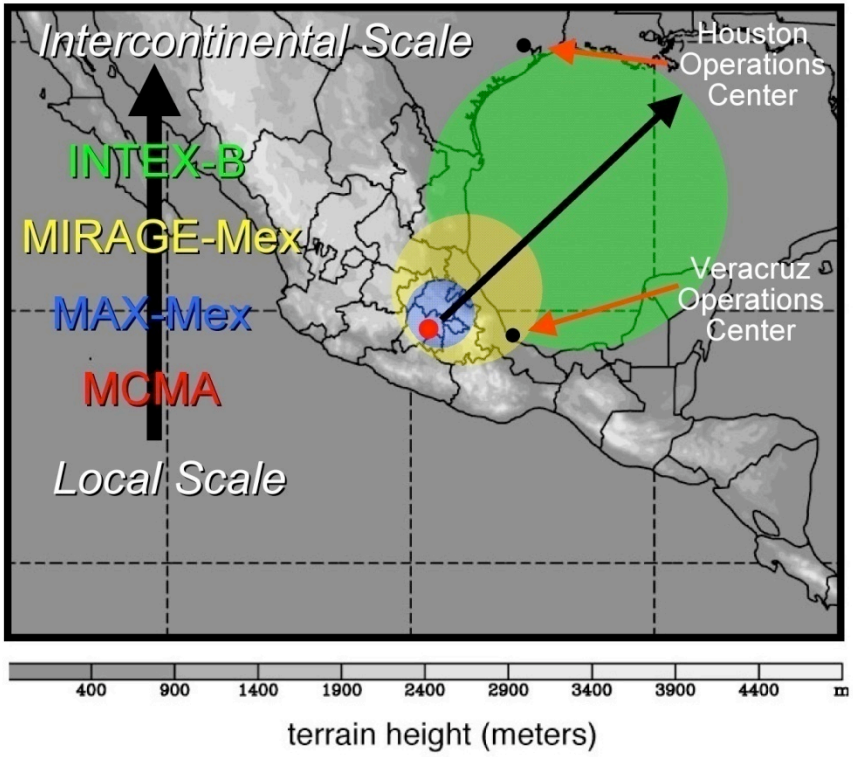
Program Manager, Bruce Doddridge



MCE²

Geographic Relation of Projects






G-1 (DOE)


C-130 (NCAR)

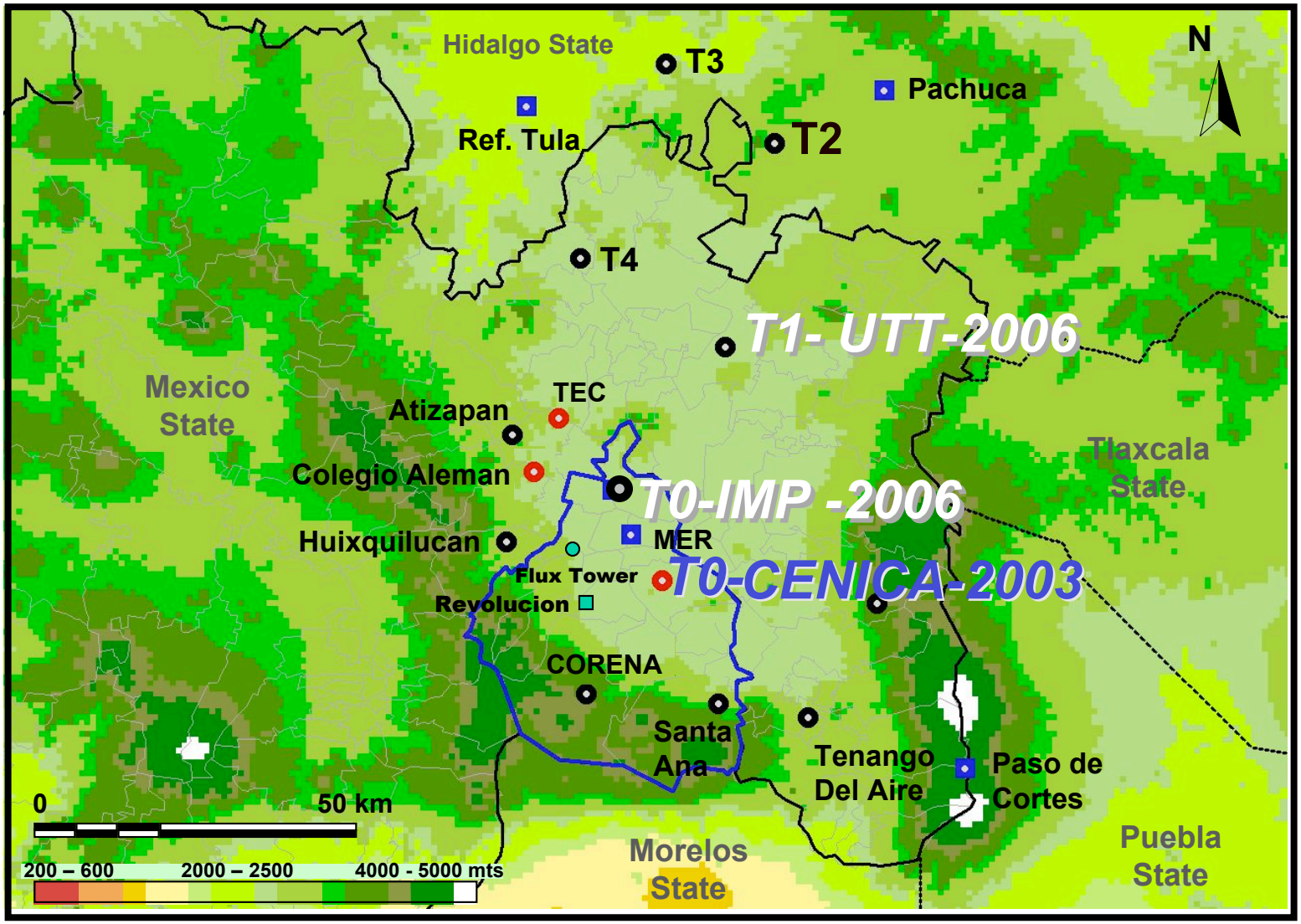

King-Air (NASA)


Twin Otter (U Montana)


J-31 (NASA)


DC-8 (NASA)

MILAGRO Measurement Sites- Aerosol Absorption



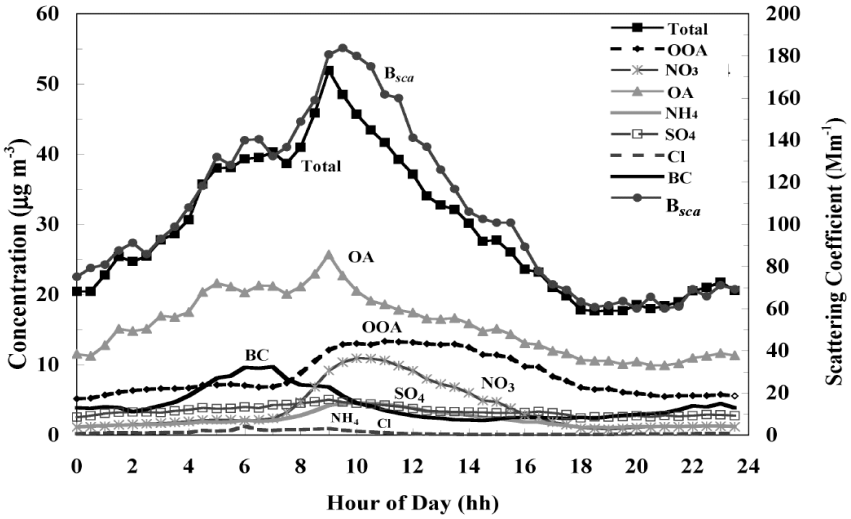
Mobile site Fixed site Other measurements

Field Campaign Period

MAX-MEX/MILAGRO Began March 1, 2006
with Data Taken to March 29, 2006

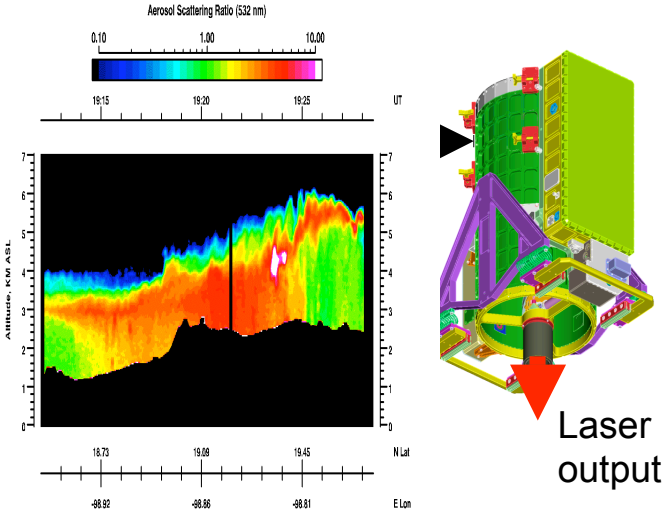
LOTS OF DATA – Burning, Rain Events, Megacity Plumes – Regional Impacts

Photo - Telma Castro, UNAM



Lupita Paredes-Miranda, W.P. Arnott, J. Gaffney, N. Marley, J. Jimenez, et al. ACPD 2008

Photos – N. A. Marley



NASA – LIDAR – C. Hostetler

Atmospheric Chemistry and Physics Special Issue ACP- MILAGRO/INTEX B 2006

- 63 papers submitted to ACPD to date
- About 1/3rd from MAX-Mex
- 32 published in ACP.. Many more in press.
- Overview Paper in progress

Strong absorbing aerosols in Mexico City and Region – ENHANCED in UVB and SHORT WAVELENGTH VISIBLE REGION… HEATING

AEROSOL AGING..ABSORPTION NOT JUST BLACK CARBON
Humic-Like Substances from Fires and Secondary Organic Aerosol Formation -
Nitrated-PAH, Nitrophenols, etc all give red-shifts in absorption.
Conjugated aldehydes and ketones.

BIOMASS CONTRIBUTION SIGNIFICANT - $^{13}C/^{14}C$
- **Agricultural Burning**
- **Trash Burning**
- **Regional Background from Fires – ~50% Recent Carbon**

Grass Fires.. Vs Wood fires – different absorption in UV

Details on Posters and Presentations that follow:
NOTE MAX-Mex DATA BEING USED IN MODELING!

11:27 **Biomass Burning** Impacts on Aerosol Absorption Exponents. **Nancy A. Marley** and Jeff Gaffney

11:34 Retrieval of aerosol single scattering albedo at ultraviolet wavelengths at the T1 site during MILAGRO - C. Corr, N. Krotkov, **Sasha Madronich**, J. Slusser, B. Holben, W. Gao, J. Flynn, B. Lefer, and S. Kreidenweis

11:41 Microscopic Characterization of Carbonaceous Aerosol Aging in the Outflow from Mexico City - **Ryan Moffet**

11:48 Evidence of increasing specific absorption downwind of Mexico City: Doran, J. C., J. C. Barnard, and **Jerome D. Fast**

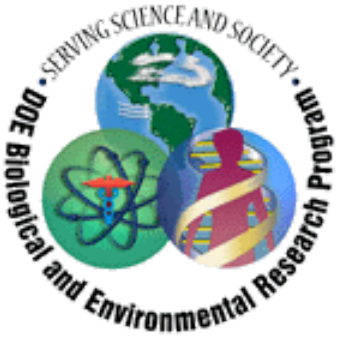
11:55 Utilizing AMS data and PMF analysis to assess regional simulations of POA from anthropogenic and **biomass burning** sources: **Jerome D. Fast**, A. Aiken, J. Allen, L. Alexander, T. Campos, M. Canagaratna, E. Chapman, P. DeCarlo, B. de Foy, J. Gaffney, J.de Gouw, J.C. Doran, L. Emmons, A. Hodzic, S. Herndon, G. Huey, J. Jayne, J. Jimenez, L. Kleinman, W. Kuster, N. Marley, C. Ochoa, T. Onasch, M. Pekour, L. Russell, C. Song, I.M. Ulbrich, C. Warneke, D. Welsh-Bon, C. Wiedinmyer, D. Worsnop, Xiao-Ying Yu, and R. Zaveri

12:02 Contributions of urban, **biomass burning** and secondary organic aerosols near Mexico City during MILAGRO 2006 - **Rahul A. Zaveri**

12:09 Time Dependence of Aerosol Properties over the Mexico City Plateau: Parts 1 to 4 - **Larry Kleinman**

12:16 Towards Understanding and Quantifying Subgrid-Scale Processes for Global Aerosol Modeling. **William I. Gustafson Jr**., Yun Qian, and Jerome D. Fast

12:23 Closure on the single scattering albedo in the WRF-Chem framework using data from the MILAGRO campaign - **Jim Barnard**, Jerome Fast, Lupita Paredes-Miranda, and Pat Arnott



ACKNOWLEDGEMENT

Thanks to the Department of Energy's Atmospheric Science Program who participated in the the Megacity Aerosol Experiment – Mexico City during MILAGRO. Thanks also to NSF and NASA for collaborative work. This research was supported by the Office of Science (BER), U.S. Department of Energy Grant No. DE-FG02-07ER64328. We wish to thank Mr. Rick Petty and Dr Ashley Williamson of OBER for their continuing encouragement. We also wish to thank Mexican Scientists and students for their assistance from the Instituto Mexicano de Petroleo (IMP) and CENICA and the Technical University at Tecamac.

GLOBAL CHANGE EDUCATION PROGRAM

http://www.atmos.anl.gov/GCEP/

LOOKING FOR MENTORS